



Ikhana

Unmanned science and research aircraft system



NASA's Ikhana Predator B received an avionics upgrade, wingtip winglets and a new paint scheme in 2013. GA-ASI Photo

NASA acquired a General Atomics Aeronautical Systems Inc. (GA-ASI) MQ-9 Predator B unmanned aircraft system (UAS) in November 2006 to support Earth science missions and advanced aeronautical technology development. Named Ikhana, the aircraft also acts as a test bed to develop capabilities and technologies to improve the utility of UAS.

Ikhana is a Native American Choctaw word meaning intelligent, conscious or aware. The name is descriptive of the research goals NASA has established for the aircraft and its related systems.

Representative Experiments and Projects

The MQ-9 aircraft, designed for long-endurance, medium-altitude flight, has been modified and instrumented for use in multiple civil research roles.

A variety of Earth science in situ and remote sensing instruments can be installed to collect data during flights lasting more than 20 hours. Data gathered by sensors on Ikhana within the Earth's atmosphere complement measurements of the same phenomena taken from space and those taken on Earth's surface.

Ikhana participated in the Western States Fire Mission that from 2007 to 2009 demonstrated improved wildfire imaging and mapping capabilities. NASA Ames Research Center at Moffett Field, California, developed a sophisticated sensor and real-time data communications equipment.

The aircraft carried the Autonomous Modular Sensor (AMS) in a wing-mounted pod in support of the wildfire missions. The AMS is capable of peering through thick smoke and haze to record hot spots and the progression of wildfires during a lengthy period. The data gathered was overlaid on Google Earth maps and downlinked in near-real time to the Inter-agency Fire Center in Boise, Idaho, and made available to fire incident commanders to assist in allocating firefighting resources.

NASA's Aeronautics Research Mission Directorate uses the aircraft for advanced aircraft systems research and technology development.

A NASA-patented fiber optic sensor system moved from years of laboratory development and testing to large-scale, dynamic field testing in 2008 when the technology was flown on the remotely piloted Ikhana to measure change in

the wing shape in flight. The effort represented one of the first comprehensive flight validations of fiber optic sensor technology.

NASA, working with government and industry partners, is providing the Radio Technical Commission for Aeronautics (RTCA) Special Committee 228 with data to support its development of minimum operational performance standard necessary for UAS to regularly access the National Airspace System (NAS).

An Automatic Dependent Surveillance-Broadcast, or ADS-B, device was first tested on NASA's MQ-9 Ikhana unmanned aircraft on March 15, 2012. ADS-B is an aircraft tracking technology that all planes operating in U.S. airspace must adopt by January 2020 to comply with Federal Aviation Administration regulations.

Through the agency's Unmanned Aircraft Systems Integration in the National Airspace System (UAS-NAS) project, NASA, GA-ASI and Honeywell International Inc. are flying a series of tests at NASA's Armstrong Flight Research Center located at Edwards Air Force Base, California. Ikhana is participating in tests that engage the core air traffic infrastructure and supporting software components through a live and virtual environment to demonstrate how a remotely piloted aircraft interacts with air traffic controllers and other air traffic. The aircraft has been equipped with a developmental sense-and-avoid system and software developed by partners.

NASA operates a ground control station and satellite communication system for transmitting flight commands to and downlinking aircraft and mission data from Ikhana. The ground control station is installed in a mobile trailer and,

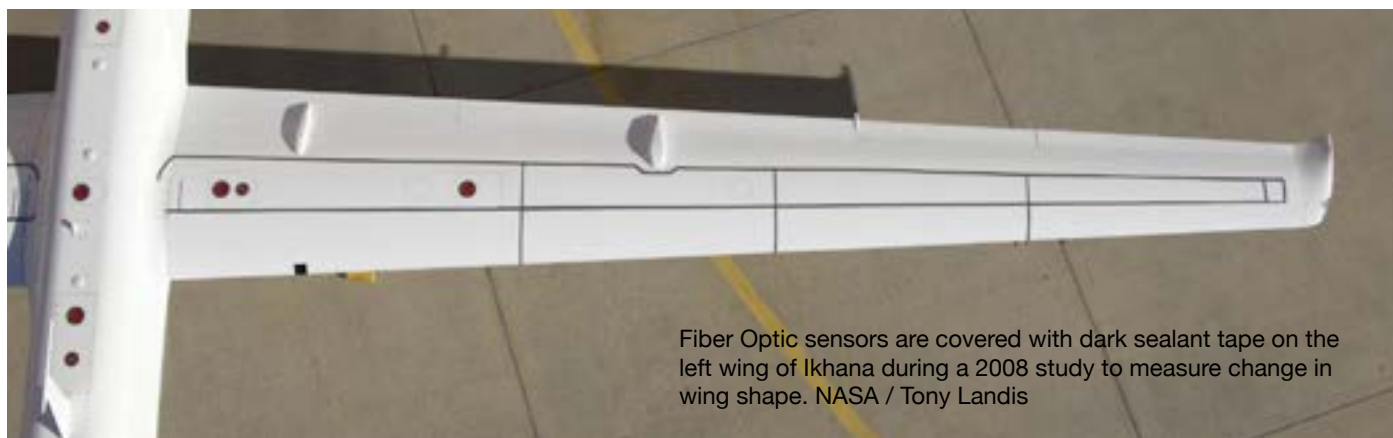
in addition to the pilot's instruments and controls, includes computer workstations for scientists and engineers. All the aircraft systems are mobile, making Ikhana an option for missions conducted from remote sites around the globe.

Aircraft Description

General Atomics Aeronautical Systems Inc. of San Diego, California, developed the original Predator A medium-altitude, long-endurance UAS during the mid-1990s for the United States Air Force. Development of the larger, more powerful Predator B was initiated in 2000 by the firm with partial funding from NASA. The agency was interested in the Earth science capabilities of a civil version of the aircraft with a larger payload and higher altitude capability, along with longer endurance. The aircraft is based at NASA Armstrong.

NASA's MQ-9 Ikhana Predator B has a wingspan of 66 feet and is 36 feet long. More than 400 pounds of sensors can be carried internally and over 2,000 pounds in external underwing pods. Ikhana is powered by a Honeywell TPE 331-10T turbo-prop engine and is capable of reaching altitudes above 40,000 feet. Ikhana was the first production Predator B equipped with a digital electronic engine controller developed by Honeywell and GA-ASI that makes the aircraft 5 to 10 percent more fuel efficient than earlier versions.

In 2013, Ikhana received a major avionics upgrade, bringing the aircraft's systems to current standards and making the UAS maintainable and sustainable. The Ikhana project also acquired a new 140-inch long, 30-inch diameter generic science pod with a payload capacity of more than 500 pounds. The pod's internal arrangement is reconfigurable to accommodate a variety of science sensors and instruments.



Fiber Optic sensors are covered with dark sealant tape on the left wing of Ikhana during a 2008 study to measure change in wing shape. NASA / Tony Landis

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